

**4725.7050 BORED GEOTHERMAL HEAT EXCHANGERS.**

Subpart 1. **Construction.** A bored geothermal heat exchanger must be constructed according to the construction standards in this part and the general construction standards in parts 4725.2010 to 4725.3875.

A. Bored geothermal heat exchanger piping must be high-density polyethylene or cross-linked polyethylene that meets the following requirements:

(1) for high-density polyethylene:

(a) pipe with a diameter of two inches or smaller, or is located more than 15 feet below ground surface, must be SDR 11 or thicker;

(b) pipe with a diameter greater than two inches, and located less than 15 feet below ground surface, must be SDR 17 or thicker;

(c) pipe must meet ASTM Standard D3035-15 or ASTM Standard F714-13;

(d) socket fusion and butt fusion connections must be made in accordance with ASTM Standard F2620-19, and electrofusion connections must be made in accordance with ASTM Standard F1055-16; and

(e) socket fittings must be manufactured in accordance with ASTM Standard D2683-14;

(2) for cross-linked polyethylene:

(a) pipe must be manufactured by the high-pressure peroxide method and designated as PEXa;

(b) pipe must meet ASTM Standard F876-20;

(c) all components of the PEXa system must be from the same manufacturer;

(d) a fitting for a PEXa system must not be buried in a pipe loop boring or between a pipe loop boring and the heat pump unit, unless the fitting is located in a vault or other structure accessible from the ground surface or floor of the building; and

(e) fittings must meet ASTM Standard F1807-19b, ASTM Standard F1960-19a, or ASTM Standard F2080-16, and ASTM Standard F877-20; and

(3) high-density polyethylene and cross-linked polyethylene pipe must have a minimum pressure rating of 160 psi at 73 degrees Fahrenheit.

B. The licensee must complete a successful pressure test of the bored geothermal heat exchanger piping after the piping is installed in the bore holes. Pipe must be pressure tested with potable water at a pressure of 1.5 times the system operating pressure or 100 psi, whichever is greater. The pressure must remain constant for 30 minutes without adding additional water.

C. The annular space between the bored geothermal heat exchanger piping and a bore hole must be filled with grout according to the procedures in part 4725.3050, subpart 2, and according to the procedures in part 4725.3450 for a bored geothermal heat exchanger boring from which groundwater flows above the established ground surface. The annular space must be filled with:

- (1) neat-cement grout or cement-sand grout in bedrock;
- (2) neat-cement grout or cement-sand grout in a boring from which groundwater flows above the established ground surface; or
- (3) neat-cement grout, cement-sand grout, bentonite grout, or thermally enhanced bentonite grout in unconsolidated materials. Thermally enhanced bentonite grout must consist of:
  - (a) a maximum of 17.5 gallons of water per 50 pounds of bentonite; and
  - (b) thermal enhancement material, including:
    - i. a maximum of 200 pounds of sand per 50 pounds of bentonite, with 80 percent or more of the sand smaller than 0.0117 inch (passing U.S. Sieve #50); and
    - ii. a maximum of 20 pounds of graphite that meets the ANSI/NSF Standard 60-2016 requirements per 50 pounds of bentonite.

D. Heat transfer fluids must be propylene glycol or ethanol that meets the following requirements:

- (1) propylene glycol must be food grade or USP grade;
- (2) a propylene glycol with additives, including corrosion inhibitors and dyes, must be certified as meeting the NSF Category Code HT1 for heat transfer fluids;
- (3) ethanol products must be designed by the manufacturer for use in bored geothermal heat exchanger systems. Ethanol products must not be used unless approved in writing by the commissioner. A complete list of product ingredients and concentrations must be submitted for review;
- (4) ethanol may be used in an ethanol-water solution of not more than 20 percent ethanol by volume. Ethanol concentrates used to prepare heat transfer fluid must be diluted to not more than 20 percent ethanol by volume before being brought into a building where the heat transfer fluid is to be used;
- (5) storing, handling, and using ethanol is subject to the safety precautions and procedures specified by the ethanol manufacturer, the applicable requirements of chapters 1305 and 7511, and NFPA Standard 30: Flammable and Combustible Liquids Code, 2015 Edition; and
- (6) no other fluids or additives may be used except for potable water.

E. A permanent sign must be attached to the heat pump identifying the heat transfer fluid in the bored geothermal heat exchanger and specifying that only heat transfer fluids approved in this part may be used.

F. Water make-up lines to the bored geothermal heat exchanger must be protected with backflow prevention according to UPC sections 602.0 to 603.5.23.4 as incorporated by part 4714.0050.

G. The isolation distance between a water-supply well and a bored geothermal heat exchanger constructed according to this part must be no less than the distances specified in part 4725.4450, subpart 1, items F and H.

Subp. 2. [Repealed, 45 SR 986]

Subp. 3. **Marking locations.** The locations of all buried bored geothermal heat exchanger piping from the point where the pipe loop exits the bore hole to the point where the pipe is exposed above the ground surface or floor of a building must be marked by:

A. a tracer wire;

B. an underground marking tape detectable from the ground surface; or

C. a ferromagnetic metal marker, detectable from the ground surface, located above the point where the pipe loop exits the bore hole.

Subp. 4. **Separation under buildings.** A bored geothermal heat exchanger boring installed using directional drilling technology that extends under a building or within three feet horizontally of the farthest exterior projection of the building must be located at least ten feet below the lowest part of the building, including the foundation and footings. Supply-return piping that is plumbed through the building wall or floor is exempt from this requirement.

Subp. 5. **Isolation distances from certain contaminant sources.** The point where the drill bit penetrates the ground surface for a geothermal heat exchanger boring must be located at least ten feet horizontally from a contaminant source that has contaminants directly entering the soil, including:

A. the absorption area of a soil dispersal system;

B. animal feedlot, confining area, or feeding or watering area;

C. cesspool;

D. landspreading area for sewage, septage, or sludge;

E. manure basin, lagoon, or storage area;

F. rapid infiltration basin;

G. seepage pit, leaching pit, or dry well; or

H. wastewater spray irrigation area.

Subp. 6. **Bored geothermal heat exchanger borings onto the property of another.** Bored geothermal heat exchanger piping must not be installed on or under property other than the property

identified in the approved permit without the affected property owner's written consent or other legal authority.

Subp. 7. **Accessibility.** The ends of each pipe loop must be accessible within a building or buried no deeper than ten feet below the ground surface. The buried ends of a pipe loop must not be built over or otherwise made inaccessible.

Subp. 8. **Pipe loop not connected to a geothermal heat exchanger system.** A pipe loop that is not connected to a geothermal heat exchanger system, such as a loop installed for thermal conductivity testing, must be protected by:

- A. extending the ends of the pipe loop to at least one foot above the ground surface;
- B. encasing the ends of the pipe loop in an ASTM Schedule 40 steel or plastic outer protective pipe that is at least four inches in diameter and extends at least one foot above and two feet below the ground surface; and
- C. covering the outer protective pipe with an overlapping cap or cover.

Subp. 9. **Sealing bored geothermal heat exchangers.** When sealing all or part of a bored geothermal heat exchanger:

- A. all heat transfer fluid must be removed from the bored geothermal heat exchanger piping that is to be sealed;
- B. the heat transfer fluid must be contained and recycled or disposed of according to applicable federal, state, and local requirements;
- C. the ends of each pipe loop must be accessed and grouted by pumping grout through a tremie pipe inserted to within ten feet of the bottom of the loop, or by pumping grout into one end of the loop until grout flowing from the other end of the loop meets the minimum specifications and densities in part 4725.0100, subpart 21d, 22b, or 30n;
- D. the portion of the piping in unconsolidated geologic materials must be filled with bentonite grout, neat-cement grout, or cement-sand grout; and
- E. the portion of the piping in bedrock must be filled with cement-sand grout or neat-cement grout.

Subp. 10. **Notice of loss or leak.** The owner of a bored geothermal heat exchanger system must:

- A. notify the commissioner of leakage from the system piping or loss of pressure in the system within 24 hours after the owner becomes aware of the loss or leak; and
- B. notify the Minnesota duty officer of a bored geothermal heat exchanger leak according to Minnesota Statutes, section 115.061.

**Statutory Authority:** *MS s 103I.101; 103I.111; 103I.205; 103I.208; 103I.221; 103I.301; 103I.401; 103I.451; 103I.501; 103I.525; 103I.531; 103I.535; 103I.541; 103I.621; 144.05; 144.12; 144.383; 157.04; 157.08; 157.09; 157.13*

**History:** *17 SR 2773; 33 SR 211; L 2013 c 108 art 12 s 108; L 2014 c 275 art 1 s 136; 45 SR 986; 49 SR 1261*

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